8x931HA USB Customer Hub

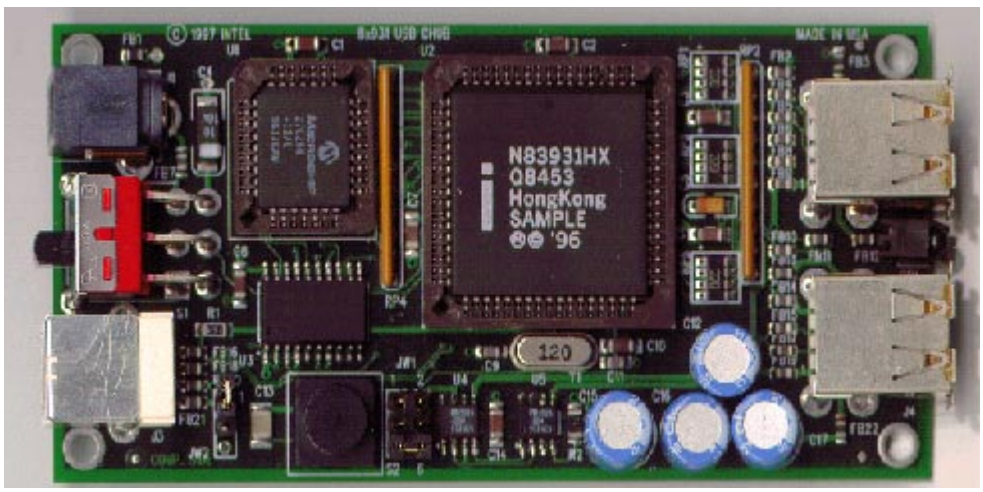
Advance Information Datasheet

Product Features

- Intel 8x931HA USB Peripheral Controller
- 8x931HA USB Hub has One Internal Downstream, and Four External Downstream Ports
- USB Hub
  - —Connectivity Management
  - —Downstream Device Connect/ Disconnect Detection
  - —Power Management, Including Suspend and Resume
  - —Bus Fault Detection and Recovery
  - —Full and Low Speed Downstream Device Support
- Hardware Reference Design
  - —Status LED
  - —Self/Bus Power Switch Options
  - —Reset Switch
  - —Internal Program Memory Option
  - —Uses High Side Power Switch for USB Power Management
    - —provides current limiting
    - —provides thermal shutdown
    - —500mA minimum continous load current per channel

The Intel 8x931HA USB Customer Hub (CHUB) is a hardware reference design for the USB system designer.

The Intel 8x931HA USB CHUB incorporates a fully functional Intel 8x931HA USB Peripheral Controller. The CHUB has undergone the same level of testing required of a commercial USB Hub product, such as USB PlugFest compliance and Intel System Integration and Validation testing.



This document contains information on products in the sampling and initial production phases of development. The specifications are subject to change without notice. Verify with your local Intel sales office that you have the latest datasheet before finalizing a design.

Order Number: 273141-003
June 1998

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The 8x931HA USB Customer Hub may contain design defects or errors known as errata which may cause the product to deviate from published specifications. Current characterized errata are available on request.

Contact your local Intel sales office or your distributor to obtain the latest specifications and before placing your product order.

Copies of documents which have an ordering number and are referenced in this document, or other Intel literature may be obtained by calling 1-800-548-4725 or by visiting Intel's website at http://www.intel.com.

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1.0 Introduction

The Intel 8x931HA USB Customer HUB (CHUB) is a hardware reference design for the USB system designer.

The CHUB serves as an evaluation platform and reference design for use in constructing a USB HUB that incorporates Intel's 8x931HA USB Peripheral Controller.

This design was built using Intel USB Development Tools. For more information visit Intel on the web.

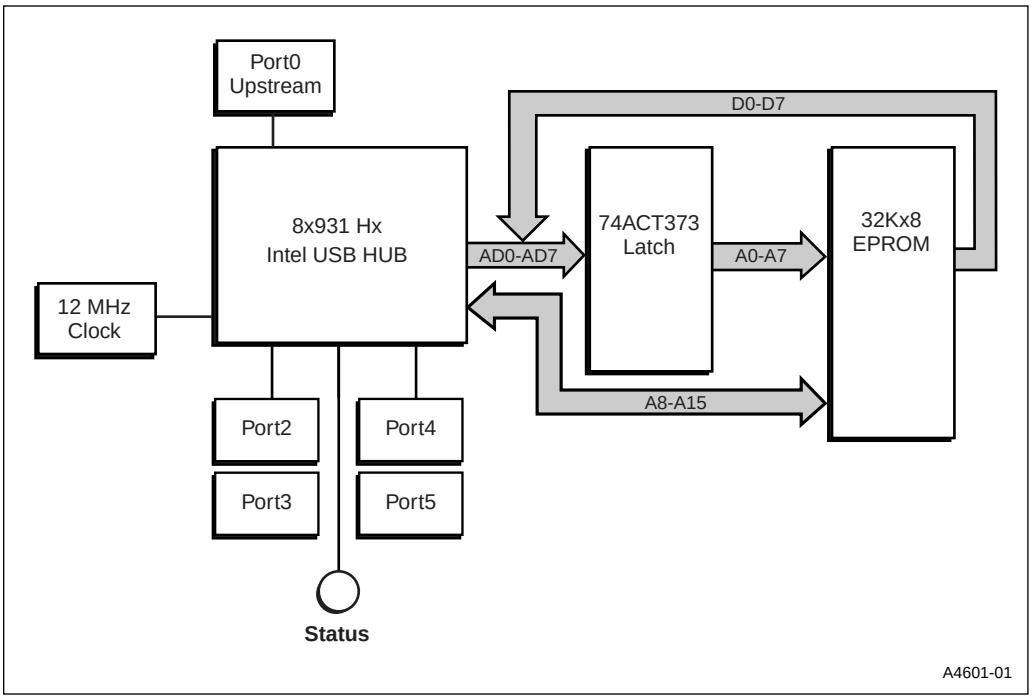
Table 1. Electronic Information

This document, as well as any updates or addendums are available at:	http://developer.intel.com/design/usb/manuals
A variety of product information is available at:	http://developer.intel.com/design/usb
USB software support can be found at:	http://developer.intel.com/design/usb/swsup
Intel 8x931HA Customer HUB schematics	http://developer.intel.com/design/usb/schems
Intel USB Specification Updates	http://developer.intel.com/design/usb/specupdt
Information about USB and specifications can be found at:	http://www.usb.org

Table 2. Related Documents

Document Title	Order Number
8x931AA/8x931HA Universal Serial Bus Peripheral Controller Datasheet	Intel Order #273108
8x931AA, 8x931HA Universal Serial Bus Peripheral Controller User's Manual	Intel Order #273102
Universal Serial Bus Specification, Rev. 1.0	Intel Order #272904
8x931HA Universal Serial Bus Customer Hub Specification Update	Intel Order #273155

Figure 1. Intel 8x931HA USB Customer HUB Block Diagram



2.0 Board Connector Interface

Figure 2 illustrates the major components of the CHUB board. See Section 5.0 for a complete component list.

Figure 2. Top View of CHUB

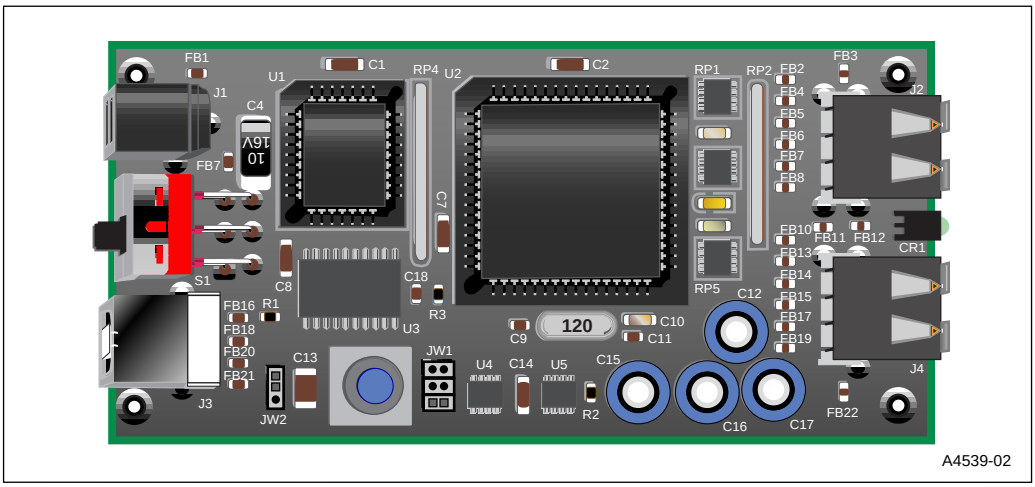


Figure 3 illustrates the connectors available to the user. The CHUB device will have a label on the bottom resembling Figure 3. Table 3 describes the device connections and their specific types.

Figure 3. Bottom Label for CHUB Device

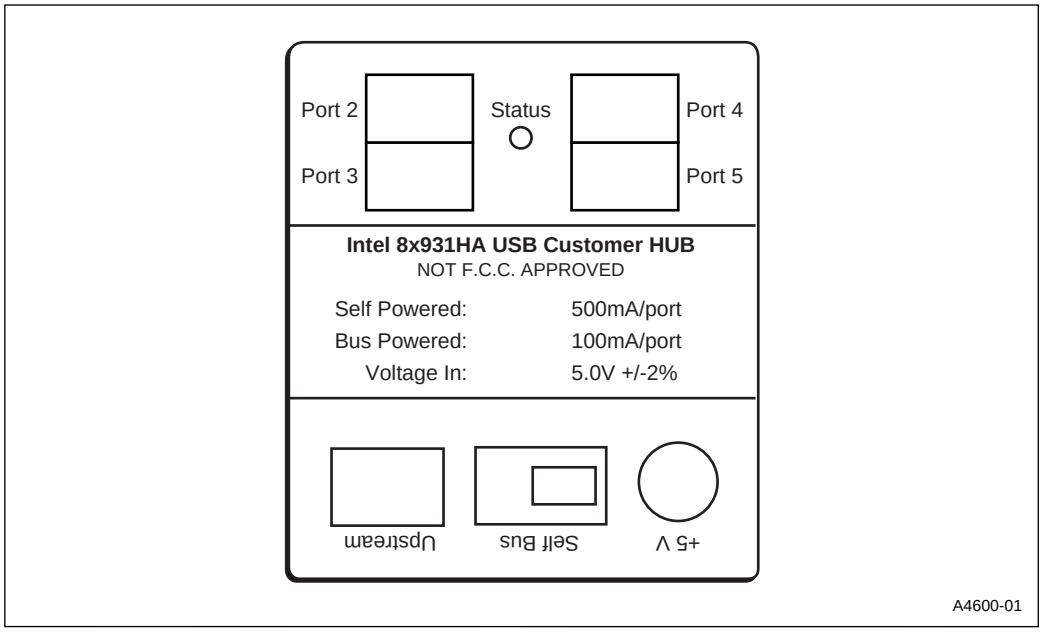


Table 3. CHUB Connectors

Description	Connector	Type	Spec
Power	J1	Input power, used for self-powered mode	5.0 V +/- 2%*
Switch	S1	Double-pole/double-throw	n/a
UPSTREAM	J3	Type B USB connector	
Port 2	J4	Type A USB connector	Self=500mA/Bus=100mA
Port 3	J4	Type A USB connector	Self=500mA/Bus=100mA
Port 4	J2	Type A USB connector	Self=500mA/Bus=100mA
Port 5	J2	Type A USB connector	Self=500mA/Bus=100mA

* See “Design Notes” on page 9 for more information on this specification.

3.0 Functional Description

The Intel 8x931HA USB Customer Hub supports self-powered and bus-powered configurations. The CHUB has 1 upstream port, and 4 downstream ports.

3.1 Self/Bus-Powered Operation

The user must decide on which power mode of operation to use. Using the switch, the user can toggle between Self-Powered Mode and Bus-Powered Mode.Section 3.6.2 explains the different modes in more detail.

Note: Moving the switch to Self-Powered Mode without a power source will reset the CHUB.

3.2 Status LED

The CHUB provides an operation status indicator LED. This status LED will start to blink once the CHUB is configured as a USB Device. Once configured, the blinking of the LED indicates execution of code from either internal or external memory.

3.3 Internal Program Memory Option

Intel's 8x931HA USB Peripheral hub controller comes preprogrammed with an internal ROM code which enumerates and configures the hub to a minimal default configuration. To use this internal ROM the user must:

1.) Carefully remove plastic enclosure. (Refer to Section 4.2)

2.) Refer to Table 4 for memory options.

Table 4. JW2 Jumper Settings

Jumper	Mode	Description
1-2*	External EPROM (EA#=0)	Customer can use Intel supplied EPROM (*default position) or their own EPROM.
2-3	Internal ROM (EA#=1)	Customer can use their own customer mask ROM for checkout or use Intel supplied ROM.

3.4 External EPROM Enabling or Disabling

The CHUB provides the user with the capability to enable or disable the external EPROM through a hardware jumper or by using software. See the following table for more information.

Table 5. JW1 Jumper Settings (Sheet 1 of 2)

Jumper	Mode	Description
1-2	ROM disabled	Hardware disabled (CE# = 1)

Table 5. JW1 Jumper Settings (Sheet 2 of 2)

Jumper	Mode	Description
3-4	ROM enabled	Enable or disable via software (P3.1)
5-6*	ROM enabled	Hardware enabled (*default position) (CE# = 0)

3.5 Firmware

The latest release of the 8x931HA firmware can be downloaded from the Intel software support website listed in Table 1 on page 5.

Refer to Table 1 for the Intel USB Specification Update website location to learn about any known errata for the CHUB[1] specification.

3.6 Design Notes

The CHUB is only intended to provide an evaluation platform and reference design for use in constructing a USB HUB that will incorporate Intel's 8x931HA USB Peripheral Controller. The CHUB is not intended to be a commercial-ready device. The intent of the CHUB is to provide a starting point to IHVs for development of their products. Users of the CHUB are responsible for all designs they may create with the CHUB.

Some trade-offs should be noted which were made to incorporate flexibility into the CHUB for evaluation purposes. Because of this, some items should be noted if this design is to be used as a base for an actual production hub. These items are listed below and may not be the only items to consider. Users need to perform their own testing of their designs to ensure that all necessary USB specifications are met.

3.6.1 Suspend Current

THe CHUB is designed to provide the user the flexibility to operate in stand alone mode or in expanded mode. Stand alone mode is defined as running firmware from on chip ROM. Expanded mode is defined as running firmware from an external EPROM.

During validation testing in external EPROM mode, the CHUB suspend current was measured at 8.0-10.0 mA. This was primarily due to the extra current drawn by the EPROM and latch. This is in violation of USB spec which specifies a maximum suspend current of 500 micro amps. When running from on-chip ROM, the suspend current was well within spec.

This should not pose a problem because in an actual production hub, the ROM code would reside in internal memory.

1. As of the printing date of this document, it was discovered that the Microsoft Memphis* Beta 3 operating system was incorrectly using the values set in the PortPwrCtrlMask field to determine which downstream ports to issue "Set Port Power" commands to upon device enumeration/configuration. This bug in the beta version, in conjunction with the values reported in the hub's port power control mask field, caused the operating system to fail to issue "Set Port Power" commands to the downstream ports on Intel's 8x931Hx hub peripheral controller. Refer to *http://developer.intel.com/design/usb/specupdt* for the prescribed workaround.

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3.6.2 Input Power Specification

CHUB is designed to run from self or bus-powered modes. Self-powered mode allows the user to plug in a 5 Volt power supply to provide HUB power. Bus-powered mode allows the user to draw power from the USB cable.

In Self powered mode, Intel has specified the power supply be 5.0 V +/- 2%. Typically, 5V power supplies do not specify to this tight tolerance. Typical power supplies are +/- 5%. The CHUB will operate and run with a 5V +/-5% power supply, but will not have the allocated voltage drop budget allowed. Any power supply used should have the ability to provide a minimum of 2 Amps continuous current.

The USB system designer is responsible for ensuring that the allocated Vdrop budget meets the USB specification.

3.6.3 Overcurrent Tripping

The CHUB has been designed to provide a .560 ms delay upon overcurrent detection. This solution has helped to solve the problem of detection of false overcurrent detections (due to hot-plugging) by delaying the input response to OVRI# by .560 ms.

Intel recommends that the USB system designer pay close attention to the method of detecting overcurrent protection for USB systems.

4.0 Mechanical Data

4.1 Module Dimensions

This section provides the physical dimensions for the Intel 8x931HA USB CHUB plastic encasing. Figure 4 shows the top and bottom views of the CHUB encasing. Figure 5 gives the device dimensions and connector orientations.

Figure 4. Top and Bottom View of CHUB Encasing

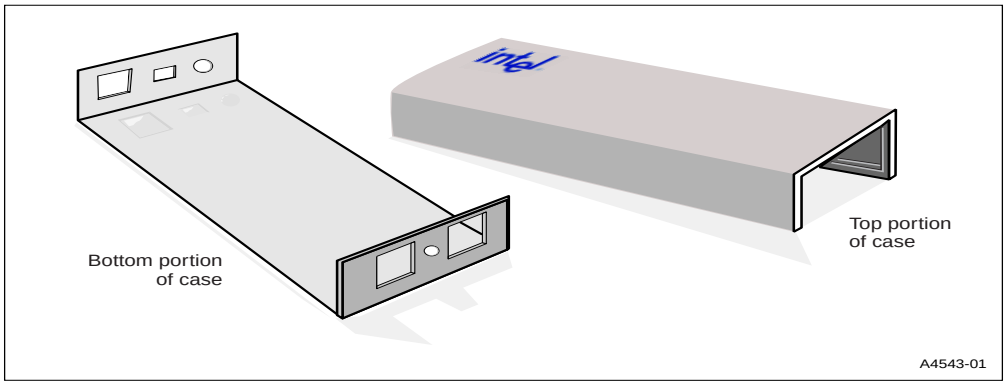
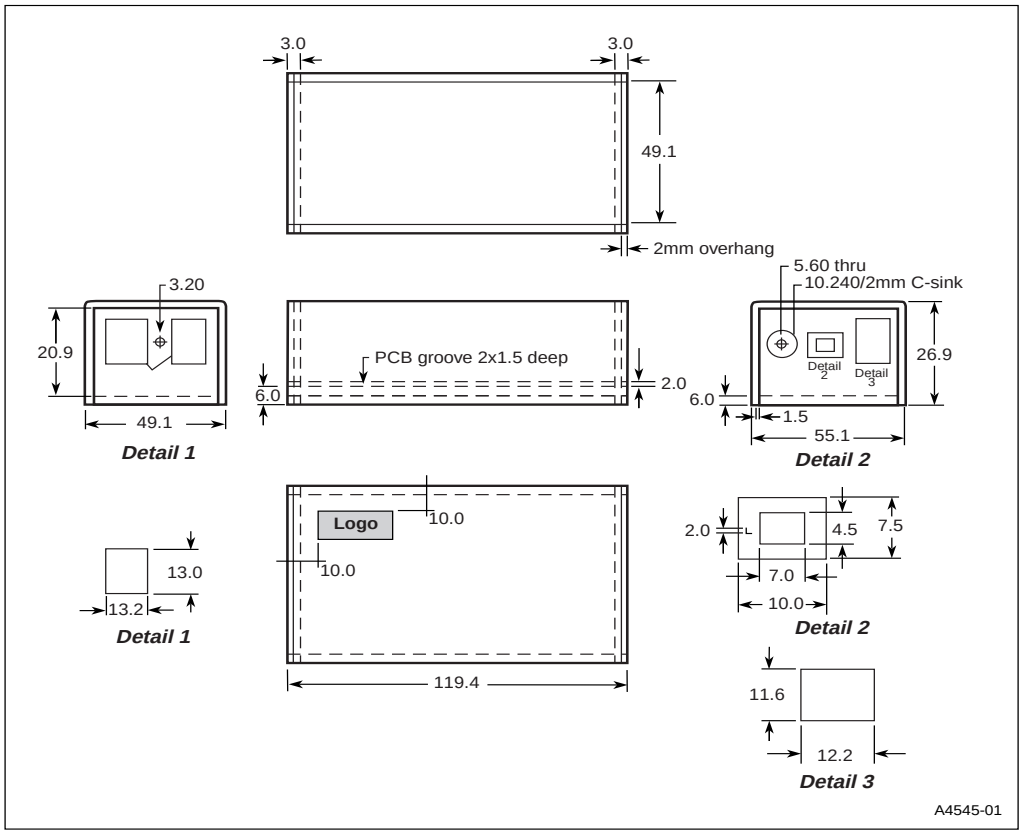


Figure 5. Device Dimensions



4.2 Plastic Encasing Removal and Assembly Procedures

The CHUB uses a molded plastic encasing to protect the PCB. Removing and assembling the plastic encasing requires some care since there are no screws used in the assembly of the PCB and the plastic encasing. Refer to Figure 4 for a Top and Bottom view of the CHUB plastic enclosure.

4.2.1 Plastic Encasing Removal

The CHUB is shipped pre-assembled. The following section briefly describes the procedure for removing the plastic encasing.

To remove the Top portion of the plastic case, the user must orient the CHUB so that the bottom label is facing the user (upside down). Take ahold of the four corners of the Top portion of the encasing and gently extend the sides away from the Bottom portion. This extension will cause the Bottom portion of the encasing to free itself from the Top portion. Gently lift the Bottom portion out, one side at a time, until the Bottom portion is completely detached from the Top portion. This frees the PCB from the grooves located on the sides of the Top portion.

Once the top portion is removed, the PCB will sit on the bottom portion. To remove the PCB from the Bottom portion, the user must gently extend the sides away from the Bottom portion, starting with the side of the PCB containing the USB connectors. Once this side of the PCB is out of the Bottom portion of the encasing, the user can lift the PCB out at a 25° angle. Be careful of the placement of the toggle switch in respect to the Bottom portion. Pulling out the PCB without angling it may cause damage to PCB and the Bottom portion.

4.2.2 Plastic Encasing Assembly

This section briefly describes the procedure to assemble the Top and Bottom portions of the plastic enclosure to the PCB.

Place the PCB into the Bottom portion, as depicted in Figure 4, at a 25° angle, placing the toggle switch into its Bottom portion opening. Extend the opposite side of the Bottom portion enough to lower the PCB into the Bottom portion. Both the toggle switch and USB connectors should fit snug into their respective openings on the Bottom portion.

Note: Be careful with the LED. The user may have to adjust the LED once the above procedure is done. This can be done by gently pushing the LED into its Bottom portion opening.

Starting from one side, extend the Top portion such that the Top portion grooves can be placed onto the PCB within the Bottom portion. Perform this procedure on the second side so that both grooves on the Top portion sides are firmly holding the PCB in place. Gently push down until the PCB snaps into place, and the Bottom and Top portions are reassembled.

4.3 Component Specifications

The CHUB uses off-the-shelf components. Refer to the specific manufacturer’s datasheet for component specifications. See Section 5.0, “Bill of Materials”.

5.0 Bill of Materials

This following table contains the bill of materials used in building the CHUB. Reference the specific manufacturer's datasheet for specifications.

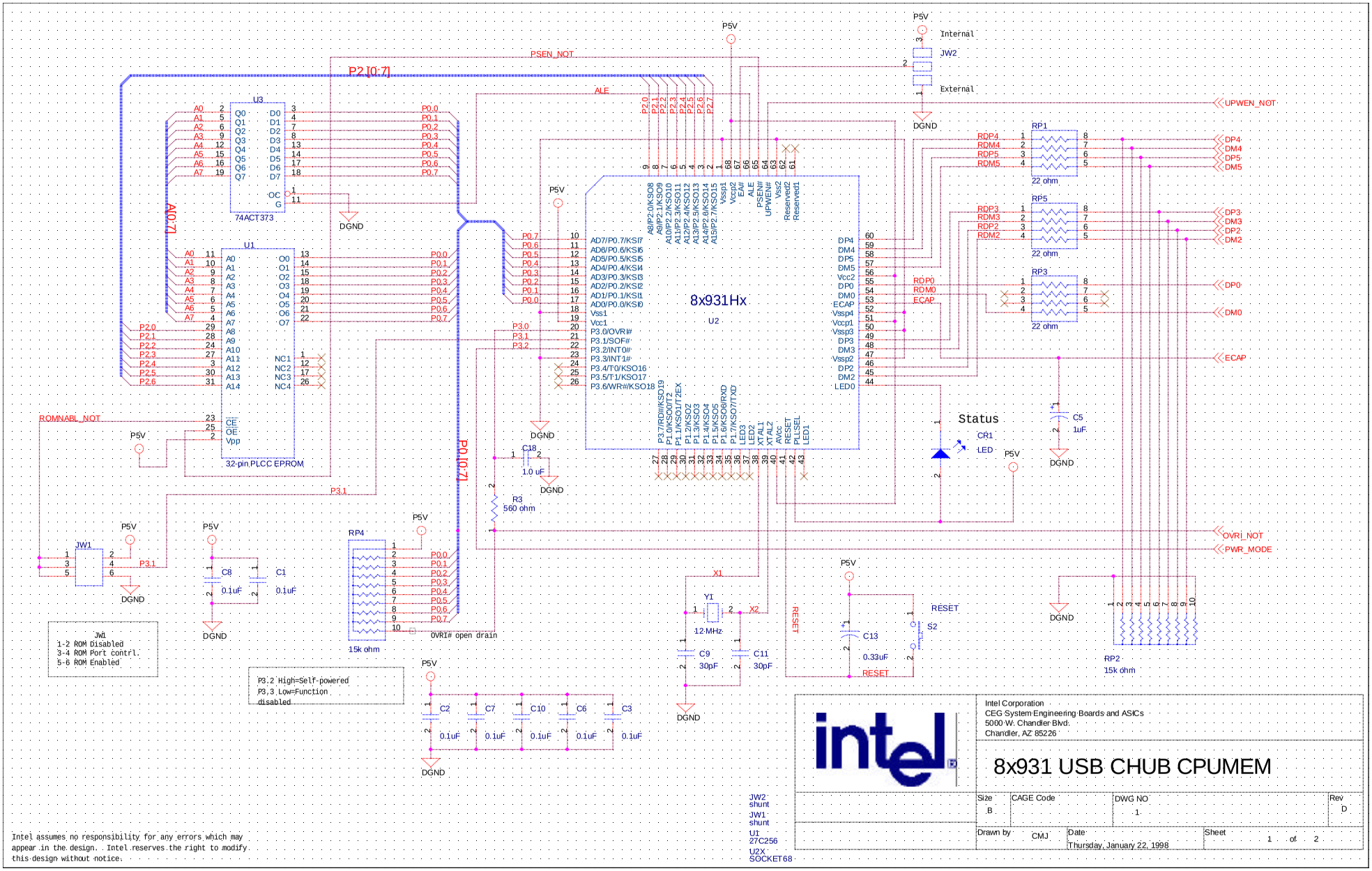
Intel does not recommend or endorse any suppliers. The inclusion of this list should not be construed as a recommendation or an endorsement of these particular suppliers.

Table 6. Bill of Materials (CHUB Rev. D)

Item	Qty	Reference	Part	Pkg Type	P/D Num	Description
1	1	CR1	LED		551-0207	T-1 Green R/A
2	8	C1,C2,C3,C6,C7,C8,C10,	0.1uF	CC1206	C1206C104M5UAC	50V 20% ceramic chip cap Z5U
		C14				
3	1	C4	10uF	6032	T491C106K016AS	T491C Tant. chip cap 16 V case-C
4	1	C5	1uF	3216	T491A105K016AS	16V 10% Tant. chip cap case A
5	2	C11,C9	30pF	CC0805	C0805C330J5GAC	50V 5% ceramic chip cap
6	4	C12,C15,C16,C17	100 uF	PCAPR140-330	94SA107X0016EBP	OSCON Radial Al Elec. 16V
7	1	C13	0.33uF	3528	T491B475M010AS	50V 20% ceramic chip cap Z5U
9	1	C18	1uF	CC1206	C1206C104M5UAC	16V 10% ceramic chip cap 0Z5U
10	12	FB1,FB2,FB3,FB7,FB9,FB12,	BLM21P300S	CR0805	BLM21P300S	30 ohm 3A 0.03 ohm DCR
		FB13,FB14,FB19,FB20,FB21,				
		FB22				
11	10	FB4,FB5,FB6,FB8,FB10,	BLM21B201S	CR0805	BLM21B201S	200 ohm 200mA 0.7 ohm DCR
		FB11,FB15,FB16,FB17,FB18				
12	1	JW1	CONN6POS	HDR2X3	68692-106	2-row unshrouded header 0.230" pins
13	2	JW1,JW2	shunt	na	68786-102	Low profile 2-pin shunt clip
14	1	JW2	JMP3POS	JMP3	90726-103	not populated
15	5	JW3,JW4,JW6,JW7,JW8	shunt		68786-102	Low profile 2-pin shunt clip
16	1	J1	CON2		RAPC-722	Phihong PSA-183 supply mate R/A PCB mount
17	2	J4,J2	USB_A_Stacked		787617-2	
18	1	J3	USB_B	USB-B	787780-1	USB Type-B thru-hole
19	3	RP1,RP3,RP5	22 ohm	CRN8/CTS744	744083220JTR	RES ARRAY 22 OHM 8TERM 4RES SMT
20	2	RP2,RP4	15k ohm	SIP10	CSC10A-01-153G	10 pin SIP resistor pack
21	1	R1	1.5k ohm	CR1206	CRCW1206	1/4 W 5% thick film chip resistor
22	1	R2	470k ohm	CR1206	CRCW1206	1/4 W 5% thick film chip resistor
23	1	R3	560 ohm	CR1206	CRCW1206	1/4 W 5% thick film chip resistor
24	1	S1	SW DPDT		1201M2S3AQE2	DPDT Slide Switch R/A PCB mount 6A @ 120V
25	1	S2	RESET	RESET	KSAOM211	SPST momentary push-button switch no
26	1	U1	32-pin PLCC EPROM	PLCC32	PLCC-32-SMT-TT	32-pin PLCC socket for EPROM
27	1	U1	27C256	na	TMS27PC256-12FML	32-pin PLCC EPROM
28	1	U2X	SOCKET68	na	PLCC-68-SMT-TT w/o loc. posts	68-pin PLCC socket surface mount
29	1	U2	8x931HA	SOCKET68	na	8x931HA USB HUB controller
30	1	U3	74ACT373	SO20W	MC74ACT373AD	Octal transparent latch Advanced CMOS
31	2	U4,U5	MIC2526-2	SO8	MIC2526-2BM	Dual USB power switch
32	1	Y1	12 MHz	XTALV	ATS-49 Standard 12.000 MHz	ATS-49 low profile thru-hole crystal

6.0 Schematics

This section displays schematics for the 8x931HA CHUB board. These schematics are also on the diskette(s) provided with this kit. These schematics may also be downloaded via the Intel web site (see Table 1 for URL).



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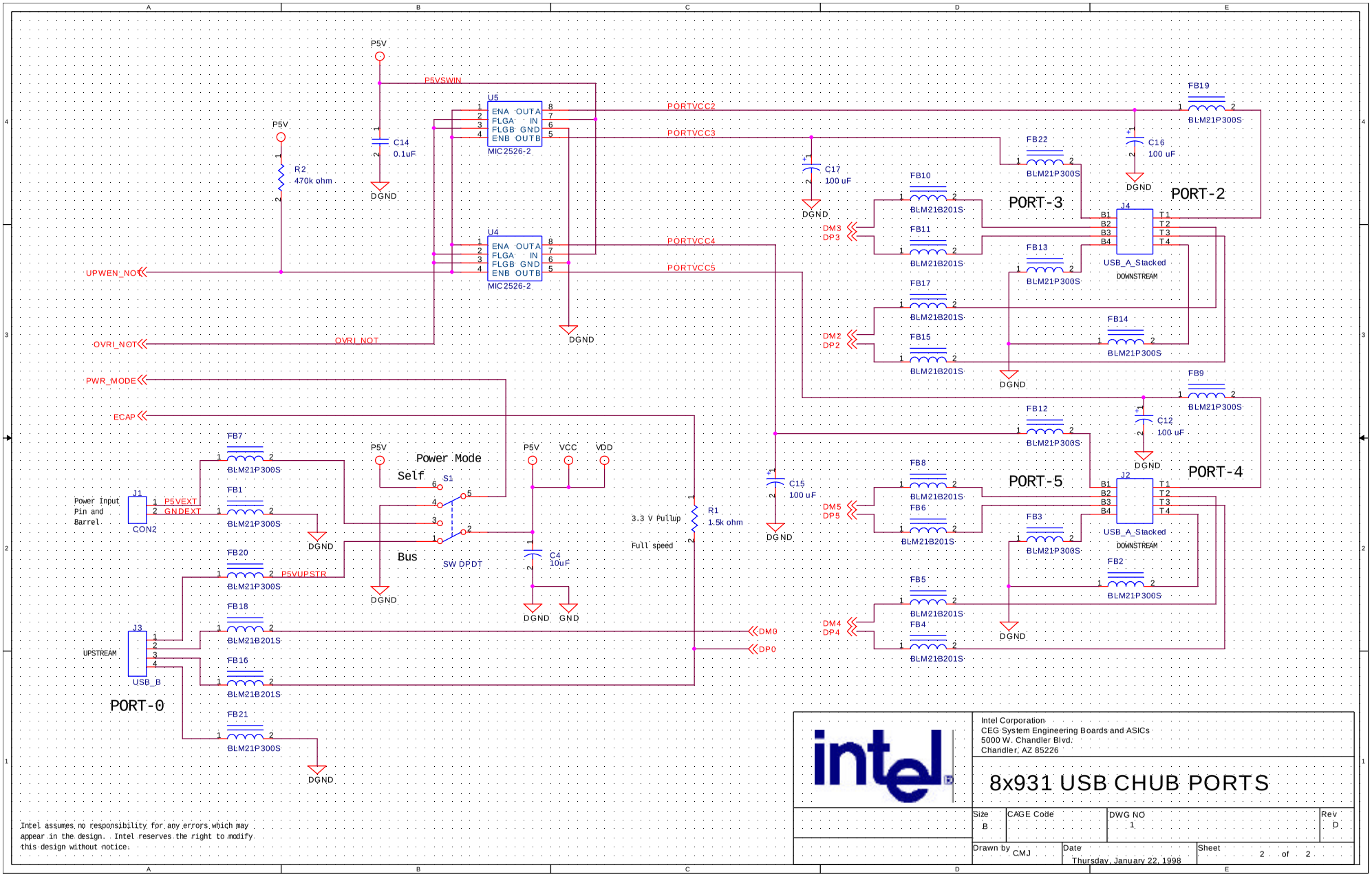
8x931 USB CHUB CPUMEM

Size	CAGE Code	DWG NO	Rev
B		1	D

Drawn by: CMJ | Date: Thursday, January 22, 1998 | Sheet 1 of 2



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8x931 USB CHUB PORTS

Size	CAGE Code	DWG NO	Rev
B		1	D

Drawn by	Date	Sheet
CMJ	Thursday, January 22, 1998	2 of 2